On the world cognizability

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Abstract

The paper gives a few examples of the phenomena that will never be understood by the mankind. The first example is the physics at the scales of $\sim 10^{-33}$ cm where the gravitation interaction becomes strong, sales at the very beginning of the Big Bang. It argues that the mankind will never establish the laws that controls the events at these scales. Further, it is supposed that the time dependence of the entropy, which determine the direction of the time arrow, originates at the same time scale and, thus, the nature of the time arrow will be never established either. Finally, I conjecture that the brain cells are controlled by quantum computer with the very large (or even infinite) number of degenerate states. An external observation destroys this degeneracy, leading to impossibility to understand the mechanism of the conscience.

The philosophers are often discussing the problem of the world cognizability. The various philosophical concepts give different answers to the question.

In this short paper I try to demonstrate, that there are a number of incognizable phenomena i.e. the ones that their nature and mechanism will never be understood by the mankind. I will consider two physical examples and one examples, based on the hypothetical mechanism of the brain operation.

I start from elementary particle physics. For long time the dream of theoretical physicists was the creation of the united theory, which would describe all interactions – strong, electromagnetic, weak and gravitational. About 30 years ago, when the string theory of gauge field was formulated, many physicists started to hope that this discovery opened the way to such theory. Unfortunately, as it became clear recently, the number of string theories is incredibly high (the estimates of their number give 10^{500} or even 10^{1000}), see e.g. [1], so it is impossible to choose among them the correct one. Even worse, after 30 years of work, the string theory could not make a any physical predictions thus failing the main test for any scientific theory. All this shows that a purely theoretical effort cannot succeed in creation of the united theory.

On the experimental side, currently the available energies extend up to energy of Large Hadron Collider (LHC) $\sim$14 TeV, which correspond to distances large than 10^{-18} cm. The study the scales $\gtrsim 10^{-18}$ cm confirm the Standard Model, which units weak and electromagnetic interactions (in the form of electroweak theory) and include4s the theory of strong interaction – QCD. According to the preliminary data the Higgs boson with the mass 125 GeV was found. With the discovery of the Higgs boson the electroweak theory become complete and selfconsistent.

The gravitational interaction has a unique position among fundamental interactions. Its characteristic scales, the distances, at which the gravitational interaction becomes strong are of order 10^{-33} cm. The region between 10^{-18} cm and 10^{-33} cm will never be investigated experimentally because the construction of an accelerator with the energies, corresponding to the distances 10^{-33} cm, i.e. with energies about 10^{16} TeV, is impossible: the Earth resources are not sufficient for it. (Indeed, the power consumed by LHC is of order 100 MWt. The increasing of accelerator energy up to 10^{16} TeV would require the power $\sim 10^{17}$ MWt=10^{11} TWt, whereas the power of world electric power stations in now (2–3) TWt.) The domain of distances from 10^{-18} cm up to 10^{-33} cm is not a barren desert as is indicated by the existence of neutrino mass and oscillations. Another indications is the abundance of the dark matter in the Universe. These facts are not accounted for by the Standard model. Thus, one cannot hope that in the energy domain 10–10^{16} TeV these is nothing besides already known interactions. Since this domain will be never studied experimentally (expect at its lower border), one comes to the conclusion that physics of smallest scales in incognizable.

The other example refer to problem of entropy. According to the second law of thermodynamics all processes in the system lead to the increase of the entropy, or, in the case of total equilibrium, do not charge it. The increase of the entropy with time is not connected with the structure of the Lagrangian, since the Lagrangian of all interactions (expect of weak interaction) are invariant under time inversion and the role of weak interaction is negligible in macroscopic processes.

Let us consider the processes occurring in the Universe and go backwords in time to the moment of the Big Bang. S. Weinberg [2] had shown that known physical laws(which are symmetric under exchange $t \to -t$) are sufficient to describe the evolution of the Universe starting from the time 10^{-4} sec after Big Bang. At the moment $t = 10^{-4}$ sec the entropy of the observed part of the Universe is only one order of magnitude smaller than its modern value[1] It is expected, that at the initial stage of Big Bang, the entropy of the world was very small. Such a possibility was formulated by Penrose [3] and considered also in Landau and Lifshitz "Statistical Physics" [4]. Therefore, the huge increase of entropy that sets the arrow of time, took place in a small time interval after Big Bang, when gravitational effects were strong and the quantum effects were significant, i.e. when the space-time quantization played an important role. This problem was discussed many times (see, e.g. [3]), but the result was unsatisfactory: no consistent explanation of the problem was found. If the increase of the entropy, determining the time arrow took place in the domain $\sim 10^{-33}$, then in accordance with what is said above, its origin will remain unclear to us.

Notice that incognizability is not a new concept in science, it is well established in mathematics where it is known that in some theories it is principally impossible to find if a given statement is true of false. There is the famous Gödel theorem, proved in 1930 [5], which states: for any system of axioms of arithmetics one can find a statement, about which it is impossible to say if it is true of false (see also [6]).

As a final example, let us consider now the work of the cells of the brain. It is clear, that there is some mechanism of control in these cells. E. Liberman [7] conjectured that the control of cells (or their associations) is due to a molecular computer. The similarity of the work the cells of the brain and the computers is discussed in details by Penrose [3]. I want to argue that this molecular computer should be a quantum computer. The main argument for this is that the quantum computer is using not only the wave function amplitude, but also its phase, i.e. the quantum computer allows to get much more information than its classical analogue

[1]The author is indebted to S.I.Blinikov for the estimation.

and as a consequence has much more extended mechanism for management. The similar property has the brain. The other argument for the quantum computer is the phenomenon of the will freedom. The human (or the animal) operates by taking decisions, the choice among alternative decisions is very quick and, probably, do not require any additional energy. This resembles the wave function in quantum mechanics that collapses to one of ground states under observation. Clearly, in the cell computer the number of such ground states must be very large. Such quantum computer might resemble that the non-abelian quantum gauge field theory: in which an infinitely large number of degenerate levels are distinguished by special topological (or winding) numbers (see, e.g. [8]). The transitions between such degenerate levels are tunnel transitions and various mixing of such levels is possible [9].

All this makes me believe that the brain relies on the quantum computation which involves a lot of generate levels and that it is the existence of these levels that determines the conscience. Of course, it is a very strong hypothesis. One corollary of it is the incognizability of the conscience. Indeed, any external intervention introduces the energy, destroys the quantum phases of levels and, as consequence destroys the conscience.

The conclusion is that there are incognizable in Nature.

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References

[1] G. Brumfiel, Nature **443** 491 (2006).

[2] S. Weinberg, *The first three minutes*, FLAMINGO, Fontana, 1976.

[3] R. Penrose, *The Emperors New Mind*, Oxford Univ. Press, 1999.

[4] L. Landau, E. Lifshitz, *Statistical Physics*, part 1, Pergamon Press, 1970.

[5] K. Gödel, Monatshefte für Mathematic and Physik, **38**, 173 (1931).

[6] V. A. Uspensky, *Teorema Gödelya o nepolnote*, M. Fizmalit, 1982; V. A. Uspensky, *Teorema Gödelya o nepolnote i 4 dorogy, vedushie k nei*, VII Letnya shkola "Sovremennaya matenatika", JINR 2007.

[7] E. Liberman, Biophysica **17** (1972) 932.

[8] B. L. Ioffe, V. S. Fadin anf L. N. Lipatov, *Quantum Chromodynamics, Perturbative and Nonperturbative Aspects*, Cambr. Univ. Press, 2011.

[9] B.V. Geshkenbein and B.L. Ioffe, Nucl. Phys. **B166** (1980) 340.